UCSD'S MedPics©:
Implementation and Impact on the Curriculum

Helene M. Hoffman, Ph.D.[1&2], Ann E. Irwin, M.D.[1], Stephen Baird, M.D.[3],
Colin M. Bloor, M.D.[3], Katsumi Miyai, M.D., Ph.D.[3], and Maria C. Savoia, M.D.[2&4]

[1]Office of Learning Resources/Learning Resources Center
[2]Department of Medicine
[3]Department of Pathology
[4]Office of Curriculum and Student Affairs
University of California, San Diego School of Medicine

MedPics is a computer-based image delivery system with supporting text fields and on-screen graphics to assist in key feature identification. It has been used by the University of California, San Diego as an integral part of the Human Disease course since 1992. Initially created to support pathology and histology, the program has now expanded to include hematology. MedPics has had a positive impact on the second year curriculum for which it was created. Moreover, use of this program has improved student attitudes toward computer-based resources and increased faculty interest in instructional development.

INTRODUCTION

At the University of California, San Diego (UCSD) School of Medicine, histology and pathology are taught as part of a large interdisciplinary course, Human Disease. Beginning in 1990, this curriculum underwent a significant review, prompted by concerns about lackluster performance on the Pathology component of the National Board Examination (USMLE Step 1), increasing student dissatisfaction, and low course morale. Our approach identified problem areas within the course, reassessed instructional objectives, and evaluated the efficacy of supporting resource materials. From this analysis, it was apparent that most students lacked the strong conceptual framework necessary for organizing the broad-based content and perceived the course as fragmented. In addition, they had particular difficulty interpreting medical images, an intellectual task new to most.

These particular problems were thought to partially reflect inadequacies of the learning environment at that time. Working in the Learning Resources Center (LRC), students used 35mm slides to "independently" review images presented during laboratory sessions. Since there were a limited number of slide sets, students tended to work in groups of 5-8, gathered around a slide projector, sharing a photocopied figure legend. The information provided in the legends varied widely, and often incorporated terminology confusing to these beginning students. Because these sessions were done without immediate faculty assistance, student interpretation of many images was incorrect or incomplete, and group dynamics influenced the learning outcome. Depending on the individuals uncertainties were resolved by consensus, persuasion by the most aggressive group member, or a trip to the faculty's office. Erroneous conclusions occasionally led students to rearrange slides within a carrousel; subsequent users were then faced with confusing image sets. Moreover, since each slide set was available for only a two week period, students rarely had the opportunity to review a set more than once. This limited access also discouraged comparisons of images in different sets, fostering the perception of course fragmentation.

To ameliorate these problems, we designed a learning environment which incorporated guidance in image interpretation, provided explicit organizational cues, and created a sense of cohesion. Moreover, making use of available computer technology, we created a self-paced instructional program that encouraged active learning. This paper describes development, implementation, and curricular impact of this system.

METHODS

This project has been ongoing for more than 3 years. Initial efforts, directed at instructional design, software development, and network access issues, were described in detail elsewhere [1]. Subsequent stages began with the introduction of a working prototype and continued through several cycles of program assessment and modification.

Development

The *PathPics* program, based largely on extant course images, was the first outgrowth of a collaboration between the Instructional Development Unit of the LRC and the Human Disease course faculty. Using the program, students were able to actively learn pathology and histology in a self-paced fashion. *PathPics* provided high-quality digital color images, descriptive text fields to reinforce course concepts, and on-screen graphics to delineate structures of interest (in effect, on-line faculty guidance). By June 1992, after 4.5 months of implementation, more than 4,000 student-use hours had been logged.

Based on user feedback, an analysis of course content, and evolving curricular needs, *PathPics* underwent significant modification. The upgraded program, a reorganized, broader-based, more generalizable image delivery system with a stronger instructional component, was renamed *MedPics*. In January 1993, the new program was integrated into the Human Disease course and another review cycle was undertaken.

The standard interface for viewing individual images within *MedPics* (Figure 1A) has remained essentially unchanged [2]. The following infrastructural changes, however, were incorporated into the expanded program:

1. Pathology and histology were separated into individual content areas to parallel changes taking place in the curriculum.

2. Hematology images from the lecture and laboratory sessions of a concurrent course were targeted as a new content area. Slide sets continue to be incorporated as they are developed.

3. The scope of individual content areas was broadened to include topics identified as poorly represented. For example, musculoskeletal histology and dermatopathology sets were created.
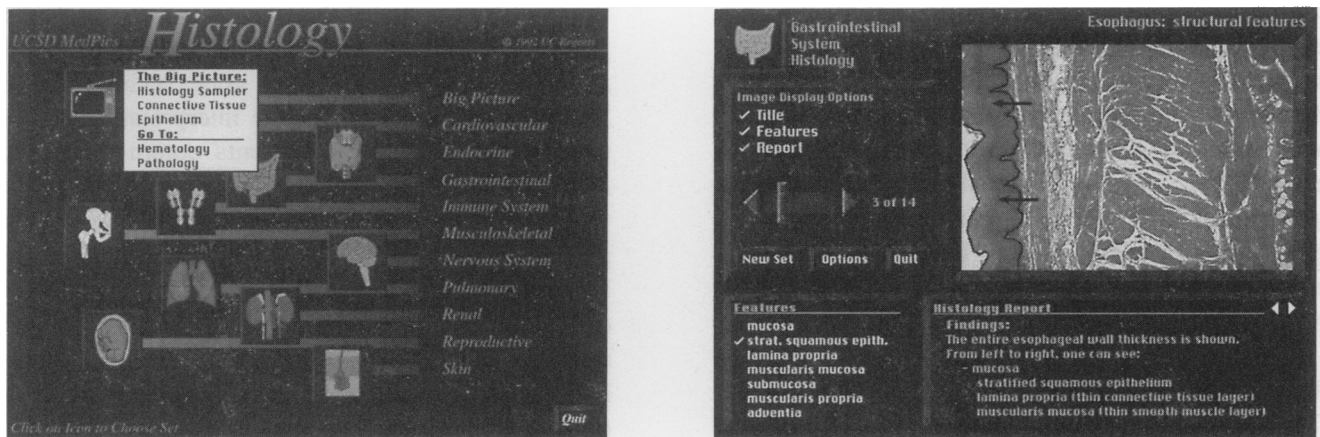

Figure 1. *A. Representative screen from the GI Histology section. Overlay identifies feature with checkmark.*
B. Table of Contents for the Histology area. The "pop-up" menu of the Big Picture section is displayed.

4. A new section, the "Big Picture", was added to each content area for global concepts and for topics which cross subject boundaries (Figure 1B).

5. An "Overview" screen was added at the beginning of each slide set detailing instructional objectives and providing an interactive directory of the images within that particular collection.

6. The key feature lists were expanded to include all major structures visible within the images. The features were then listed in an order which emphasizes layers, patterns, and relationships.

Implementation

The *MedPics* program, approximately 100 Mb in size, was loaded for distribution to a file server running Novell Netware 386 v3.11. Fourteen networked 8-bit color Macintosh computers in the LRC were the primary worksites. To distribute access equitably, reservations for these computers were limited to blocks of two hours per day, and students were encouraged to work in groups of 2-3. Fifteen additional networked Macintosh computers in the teaching laboratories, medical libraries, faculty offices, and at affiliated hospitals were available, but not used as frequently for reviewing *MedPics*.

In the first week of the course, a 45 minute *MedPics* orientation was presented to the class. Students were introduced to the overall organization of the program, shown the navigation scheme and color-coding conventions (e.g., all white text is "active"), and familiarized with program options including standard display and quiz modes. Following the orientation, students were encouraged to ask questions and try the program. Thereafter, assistance in running the program was rarely needed because the standard screen layout and intuitive navigation conventions were easy to learn and use.

Evaluation

To evaluate the effectiveness of *MedPics* in our Human Disease curriculum, we used both objective and subjective measures, including student performance on the Pathology component of the USMLE and surveys administered immediately following section exams (1992), or at the end of each quarter (1993). These anonymous questionnaires examined user satisfaction and, starting in 1993,

addressed utilization as well. Students and faculty were also encouraged to provide feedback directly to the LRC's Instructional Development Unit.

RESULTS

Results for 1992 and 1993 (Table 1) clearly demonstrated that the program was perceived as useful by those students responding to the surveys. The 1992 data is shown summarized by quarter (120 students total; Winter quarter: 3 exams, n range of 79-128, avg. = 98; Spring quarter: 4 exams, n range of 50-74, avg. = 61). The 1992 response rate was consistent with 1993 observations (Winter, n = 60; Spring, n = 66), and with other UCSD courses.

Table 1
Student perception of program usefulness (%)

Academic Quarter	Very Useful	Somewhat Useful	Not Useful
Winter '92	80.9	16.7	2.4
Spring '92	52.5	30.7	16.8
Winter '93	70.0	26.7	3.3
Spring '93	56.1	36.4	7.5

Written comments submitted to the LRC support these findings. For example, many students found the "graphics very helpful" because they "took the guesswork out of studying". Some preferred *MedPics* to traditional glass slide review, citing "reduced ambiguity" in image interpretation as the primary factor. Many students commented that *MedPics* "made studying fun". Negative comments were almost exclusively directed to the absence of, or gaps in, program content (e.g., "Put more slides from lecture in *MedPics*", "include multiple examples of each concept"). This was reflected in lower usefulness ratings for topics made available as "work-in-progress" (in general, new slide sets or revisions to existing sets), primarily in the Spring quarters.

Based on 1993 survey responses and by observation of students in the LRC, the following utilization trends were identified:

1. Although three students typically shared a session, those who preferred to work alone were usually able to find non-prime times to do so.

2. The majority of users both quarters reported up to 2 hours/week using *MedPics*. This increased in the Spring (Table 2) even though time spent at each *MedPics* session remained constant.

Table 2
Average Time Spent Using MedPics (%)

1993 Quarter	Hours/week: 0	<1	1-2	2-4	>4
Winter	3.9	57.7	36.5	1.9	0
Spring	0	24.6	44.9	27.5	3.0

1993 Quarter	Hours/session: 0	<.5	.5-1.0	1-2	>2
Winter	1.9	5.8	25.0	57.7	9.6
Spring	0	6.3	28.1	57.8	7.8

3. While some students used *MedPics* to preview topics, most scheduled review after the associated laboratory session.

4. Study strategies varied, but most students examined each set one or two times (Table 3). When complex issues or structures were involved, and in the Spring quarter generally, students reported reviewing each topic more frequently.

Table 3
Reported Frequency of Review/Topic (%)

1993 Quarter	Frequency of review (#): 0	1	2	3	4
Winter	3.8	44.3	44.3	3.8	3.8
Spring	0	29.7	59.4	10.9	0

5. When viewing a slide set for the first time, users preferred the default setting which displays all available instructional and descriptive information. For subsequent review (primarily pre-exam), most users preferred the Quiz mode as a self-assessment tool.

The 1993 surveys also sought to establish whether using *MedPics* had influenced student attitudes:

1. The majority of respondents denied that using *MedPics* had modified their usual approach to studying. However, this figure dropped from 86.3% in Winter to 54% in the Spring quarter. Typically, students cited increasing time on campus at sites where they could access the program, increasing time spent studying in peer groups, and a greater tendency to initiate discussions with faculty when clarification was sought.

2. Most students denied that *MedPics* had changed their attitude toward computers (Table 4). However, Spring quarter results were notable for the exclusively positive impact reported by those whose attitudes were affected. Many comments referred to an increase in overall confidence using computers, prompting some to expand their normal routine to include other instructional software programs, on-line library resources, and electronic mail.

Table 4
Change in attitude toward computers (%)

1993 Quarter	Change in attitude: Yes, +	Yes, -	No
Winter	30.8	5.8	63.4
Spring	46.7	0	53.3

Following the first year of program utilization (1992), student performance on the Pathology component of the USMLE Step 1 increased by 3 percentage points over 1991. 1993 scores again show improvement, increasing 7% over 1992 scores, and fully 10% over 1991.

DISCUSSION

Teaching students visual discrimination and recognition skills requires particular attention, since it is a learning process "fundamentally different from the knowledge derived from words"[3]. Moreover, a cohesive cognitive framework must be established which provides the context necessary for students to master complex intellectual concepts and integrate large volumes of didactic material. The *MedPics* project originated as one facet of a broad-based effort to strengthen the curriculum of UCSD's Human Disease course and improve the student experience in these areas.

Objective analysis of *MedPics'* impact on student performance remains premature. First, the software was used for only four academic quarters, undergoing significant modification during that time. Second, potential analysis of Human Disease course section exam results was confounded by concurrent (and ongoing) curricular revision, changes in instructional

approach implemented by newly-designated faculty section leaders, and significant modifications to the testing format. Analysis of USMLE scores was complicated by changes in the testing format and reporting scales implemented in 1991. The 7% increase seen this year over 1992 scores reinforces the modest 3% improvement seen last year, and is certainly encouraging. These results likely reflect a combination of factors, including the enhanced student interest in the pathology course since the introduction of the *MedPics* program.

As Walsh and Bohn (1990) point out, while improved test performance certainly reflects positively on any educational tool, it should not be considered the sole measure of instructional efficacy [4]. Subjective data to date clearly indicate that *MedPics* has succeeded in strengthening the curriculum. Students found it to be an effective, efficient, and enjoyable study tool which kindled their enthusiasm for this material. The graphic overlays are uniquely effective in that the outlines clearly delineate boundaries unlike arrows which may leave exact structural limits ambiguous to beginning students. The Human Disease course was viewed more favorably, and morale improved. Moreover, faculty appreciated and capitalized on the opportunities for course development that the flexible *MedPics* template provided. For example, small gaps in the curricular content were filled without allocating additional lecture time, strengthening instructional content.

MedPics raised student and faculty expectations, stimulating it's expansion within our curriculum. Students have urged that all images and concepts introduced in this and other courses be represented, rather than following the original concept which included only images from labs in a single course. Having observed that students assimilated this material much more readily when opportunities for self-paced study and repetitive examination of images were provided, faculty are extending *MedPics* to encompass a broader base of visual exposure. The addition of multiple images exemplifying the same concept will further facilitate student acquisition of enhanced visual skills.

The popularity and efficacy of the program was one of the major stimuli which fueled a cultural shift in the medical school's learning environment. The LRC facility grew to embrace contemporary instructional technologies, serving as the medical school's academic computer center and the hub of a large educational computing network. As technical issues of *MedPics* delivery were resolved, independent image review outside the LRC became practical. Faculty and students at remote sites can now access on-line instructional resources, enabling housestaff active participation in this new learning environment.

MedPics now sets a standard by which other teaching materials at UCSD School of Medicine are judged. Consequently, there is strong pressure for other courses to improve their supporting materials by taking advantage of these instructional technologies. The collaboration between the LRC Instructional Development Unit and course faculty that successfully produced *MedPics* has become a model for the design and implementation of future projects. This fall, our first year Cell Biology and Biochemistry course will utilize *MedPics* as an instructional vehicle for the first time.

References

[1] H. Hoffman, A. Irwin, and R. Ligon. (1992) *PathPics: Image Review and Tutorial Program from the University of California, San Diego*; Learning Resources Journal; University of Minnesota, Health Sciences; S. Schoenfelt, Ed., pages 8-11.

[2] H. Hoffman, A. Irwin, and R. Ligon. (1993) *PathPics: An Image Based Instructional Program Used in the Pathology and Histology Curriculum and Transmitted Over A Wide Area Network*; Proceedings of Sixteenth Annual Symposium on Computer Applications in Medical Care, pages 796-797.

[3] B.M. Stafford (1991) Body Criticism: Imaging the Unseen in Enlightenment Art and Medicine; Cambridge Mass, MIT Press.

[4] R.J.Walsh, R.C. Bohn.(1990) *Computer-assisted instructions: a role in teaching human gross anatomy*; Medical Education; 1990(24):499-506